

# AUSTRALIAN OS9 NEWSLETTER

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Number 3

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**AUSTRALIAN OS9 NEWSLETTER**  
**Newsletter of the National OS9 User Group**  
**Volume 8 Number 3**

**EDITOR :** Gordon Bentzen  
**SUBEDITOR :** Bob Devries

**SUPPORT :** Brisbane OS9 Level 2 Users Group.

**Greetings and solutions!** Well at least we do hope that you find a solution to at least one problem in these pages. My editorial comments from March prompted one reply. Thankyou Stan Blazejewski for your letter and comments. He writes :-

"I'm sending this letter for two reasons, one, to let you know that there is another BBS that supports the CoCo and the OS9 operating system (for six years now and registered for five years, seven months). It has expanded from a CoCo 1 and a couple of floppies to a 512k CoCo3 with 45meg hard drive. A mention in the OS9 newsletter would be nice :-) ....

Name ..... Peninsula Colour Computer Club BBS  
Phone ..... 03-580-4604 (int'l 1 +613-580-4605)  
Times ..... 9:30pm to 7:00am (ARST)  
Baud ..... 300 - 2400  
Computer ... 512k CoCo3  
Operating .. OS9  
Software ... RiBBS v 2.02

(I have a 9600 baud modem & RiBBS 2.1, I just haven't managed to get around to installing them).

O.K, now to the reason I'm writing. In the last newsletter you asked about the 'C' source code published and wanted comments about the material in the newsletter. I find 'C' a little beyond me at present and up until those couple of articles about the comparisons between RS BASIC and BASIC09 I wasn't having much luck with BASIC09 either. I found the articles invaluable, all of a sudden it all made sense and I have successfully converted a couple of programs just for the learning experience and written a couple from scratch, one of which is a simple version of Presto Partner which I found to have a serious bug that corrupted the reminder file and that was all I ever used it for anyway! Personally I would like to see more of these BASIC09 articles. I'm sure that not "all" the subscribers to the newsletter have advanced to 'C' and if they had a better understanding of BASIC09 it might just be the stepping stone that they need!

**TREASURER :** Jean-Pierre Jacquet  
**LIBRARIAN :** Rod Holden

I had a bit of a chuckle when Rod Holden commented "feast your eyes on this lot" and proceeded to give us a directory listing of part of his RiBBS download directory. Unfortunately, most of the files had rather cryptic names and gave no idea as to what they were or did. Surely he must have "RLIST" that will give a nicely formatted listing of all the files in the selected areas.

**EXAMPLES OF LISTING PROVIDED .... Ed.**

I don't remember if I replied "yes" or "no" to submitting an article for the newsletter but either way I have enough trouble coming up with enough info to put into our clubs' newsletter for the president's bit. Who knows, I might get the urge one day and write something for you to publish. Maybe you could start a "letters to the editor" and put this letter into it! But that would assume that you have subscribers send you letters." Stan Blazejewski

April 17, 1994

**USERGROUP FUTURE**

Firstly, our Librarian and BBS Sysop, Rod Holden has "done a deal" for the sale of his CoCo3 system which means that we have a fair gap to fill. I believe that Rod plans to have the BBS available until the end May approximately. Also, if you have library requests we will fill these by one means or another.

Secondly, We have now reached the point where we do not plan to continue the Australian National OS9 Usergroup beyond the current subscription year. Current subscriptions expire in August 1994 and the last newsletter will be mailed then.

**APOLOGY**

This edition is a combined April, May effort as we did not prepare a newsletter for the month of April. Bob Devries had material ready as usual but I did not do my bit due to many other responsibilities at work and travel plans which could not be changed. I hope that this does not cause anyone any inconvenience.

Regards, Gordon.

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## AUSTRALIAN OS9 NEWSLETTER

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### SECAD OFFER

Great News!

You can now get into OS-9/68000 for less cost than ever before. Secad Systems has made an offer to sell their 68000 based AS-68K for \$320.00. The offer is ONLY available through me, so call me, or write to me if you are interested. The address is below.

For this price you get:

1. One AS-68K Printed Circuit Board, BARE (no components), complete with instructions on what components are needed, and where to put them.
2. OS-9/68000 Professional, complete with manuals. This includes the usual OS-9 utilities, the C compiler, Assembler, Linker, and a text Editor.
3. Complete AS-68K users manual detailing any special software which is included on the four (720K) disks supplied.
4. OS-9 Boot ROM, and programmable logic array chips.

This offer is especially good for electronic tinkerers, and those who love a challenge. To make this into a working system, you'll need:

- IBM XT case and power supply.
- IBM XT multi-I/O card (includes clock, serial, and parallel ports).
- IBM XT disk drive card (this may be included on multi-I/O card).
- IBM XT Hercules or CGA graphics card and monitor.
- Either 3.5" or 5.25" 720K disk drive(s). Other formats (360K) may be available, please ask.

#### OPTIONS:

- Hard disk and controller (either Western Digital WD-1002, or DTC5150 or DTC5160), either MFM or RLL may be used. Also Seagate ST-01 SCSI controller and drive.
- IBM XT internal modem card.
- VGA card and monitor, provided suitable driver software becomes available.

If you are interested, please contact me at the address below. Don't miss out on this offer, it is a great way to get into OS-9/68000.

Here is a bit of blurb on what this computer is all about:

### AS-68K SYSTEM FEATURES HARDWARE FEATURES

The AS-68K is a Motorola 68000 based micro-computer board, running at 10 MHz. The board is designed to directly replace an IBM-XT mother board. It is hardware compatible with IBM-XT components, but is NOT software compatible. The AS-68K will bolt directly into an XT style case and use an XT power supply, keyboard, floppy/hard drives and most XT compatible plug in cards.

An 8 slot IBM-XT I/O bus is implemented in hardware with 2 PAL's to simulate a standard XT I/O bus timing running at 4.77 MHz. All the features of the XT I/O bus have been implemented including DMA and interrupt requests. The I/O bus interface also transparently controls the multiplexing of the 68000's 16 bit data lines into the I/O bus's 8 data lines. Therefore there are no restrictions on the use of 68000 word or long word instructions on the I/O bus. The I/O bus is mapped as 1 M byte of contiguous memory, plus 64 k bytes of I/O ports so as to fully utilise the XT's memory and port address range.

Other hardware features of the AS-68K are:-

- Zero wait state DRAM, 2 Mbytes using 16 \* 1Mbit DRAMs (41C1000 or similar), expandable onboard to 4 Mbytes by the addition of 16 extra DRAM I.C.'s.
- Four 28 pin DIP sockets providing 16 k bytes to 128 k bytes of EPROM.
- A four channel DMA controller (68450 DMAC). Channel zero is used for DRAM refresh, taking about 6% of system time. Channel 2 supports the XT compatible floppy disk controller card. Channel 3 supports the XT compatible hard disk controller card. Channel 1 is free for user applications.
- Two RS-232-C (DTE) ports (68681 DUART).
- XT compatible keyboard (1/2 6821 PIA).
- A general purpose 8 bit I/O port (1/2 6821 PIA). This port may be used with a DIP switch to set system configuration for special applications, or used as a general purpose 8 bit I/O port.
- A simple single tone sound generator, for use as

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a keyboard beeper or "bell" (^G).

### SOFTWARE FEATURES

The AS-68K is supplied with Professional OS-9/68000 operating system by Microware. Features of Professional OS-9 are:-

- True multi-user, multi-tasking ability. With a Multi-I/O card and a video card this system will support 5 users. (2 serial ports on Multi-I/O card, 2 serial ports on main board plus video card and XT keyboard = 5)
- UNIX style operating system with most of the standard utilities and features.
- Supports hierarchical disk file structure, I/O redirection, named and un-named pipes, parallel and sequential processes.
- Because of OS-9's modular structure, use of relocatable code and the separation of code from data space, application programs and OS-9 are ROMable, making multi-tasking, diskless or dedicated systems simple to achieve.
- Software device drivers and device descriptors can be easily written and added to the system for any hardware device. 80x86 based plug in "Turbo" cards are NOT applicable to this system.
- Professional OS-9/68000 is bundled with a K & R, UNIX compatible C compiler, Assembler, Linker, Make utility, Debugger and uMACS advanced screen text editor.

- The following high level languages are available:- Basic, Pascal, Fortran 77 (and FORTH "soon").

- Many application packages are available including:- a word processor (Stylograph), a spread sheet (DynaCalc) and 4GL database management (Sculptor).

### OTHER FEATURES

- The following OS-9 documentation is supplied with the AS-68K:-

Using Professional OS-9,  
Technical OS-9 Manual,  
Assembler/Linker/Debugger User's Manual,  
C Compiler User's Manual,  
Using uMACS.

AS-68K User Manual supplied. This manual includes circuit description, diagrams, board layout and code examples.

Motorola Hardware Technical data books for 68000 CPU, 68450 DMAC, 68681 DUART and 6821 PIA are available.

Bob Devries  
21 Virgo Street  
INALA. Qld. 4077  
Australia

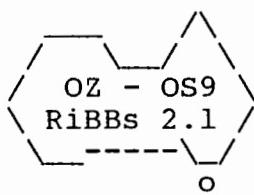
PH: (07) 2787209  
FAX: (07) 3728325

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The National OS9 Usergroup  
(07)-805-5980  
300/1200/2400/9600/14400 baud.  
20:00 to 21:30 HRS.(AEST)  
(8N1)

Co-ordinator: Bob Devries (07)-278-7209  
Sysop: Rod Holden

This is (Ribbs).... A Tandy Coco Based BBS program.  
This BBS is accessible to Usergroup Members ONLY!  
Feel free to look around , and test out the options.

OS9 for Ever !!!!

This is your Sysop giving you a directory listing of what type of software is available, feast your eyes on this lot;

This is a continuation of last month's list. There's a lot more, so you'll see we have a HUGE supply of PD files.

DNLD/OS9\_TEL

access2.ar	aciapak.ar	adxql01.arc	bbterm.pak	bin.ar	bitbang.pak
cbin.ar	chopthrd.ar	door.pak	dobble.ar	fixar	jtdir.ar
jterm.pak	kermdoc.pak	kermit.pak	osterm.pak	rs232fix.ar	runner.pak
rzs2.arc	sacia.arc	screx.ar	scribe3l.ar	seditor2.pak	sprcm2la.pak
telstar3.pak	tsmon.ar	tsutils.ar	ultaciac.ar	view.ar	wizprol.ar
wizpro2.ar	wizpro3.ar	xmac.ar	xymodem2.pak	sprcm22.ar	hi_speed.ar
scribe40.pak					

DNLD/OS9\_UTI

acul0.arc	alias.ar		ar13.ar	ar14.arc	asciitbl.ar
attrchg.pak	bootli.ar	bootspli.ar	bru.ar	call.ar	check.pak
clear.ar	cmdcrd.ar	col.pak	convert.pak	crc32.arc	cron2.ar
crypt.pak	datamod.ar	ded3.pak	dedpatch.ar	delf.pak	device.ar
dirpak.pak	dirsrt.ar	dirutl.ar	disksave.ar	dls.ar	dmode.ar
dscan.ar	dupfile.pak	easyedit.ar	ezdir.ar	fastback.pak	fatdsp.ar
fcopy.pak	ffix.ar	fix.ar	fixtxt.ar	fspark3.ar	fsedit.ar
fsize.ar	fstat.ar	fudge.ar	gdmap.arc	getnw.pak	grep.pak
hdo.ar	iback.ar	idcpy.ar	if.ar	ileave.ar	infix.ar
jtfml5.ar	jtree.ar	kdutils.ar	kformat.pak	kutil.ar	label.ar
ifstrip.ar	lister.ar	lmerge.ar	mcopy.ar	md.ar	menus.ar
modbuster.ar	mode.pak	modutil.pak	more.ar	move.ar	mroff.pak
mv.ar	oki rtc.ar	optstart.ar	os9arc.arc	pak.ar	park.ar
pcdos.ar	pfonts.ar	ps.ar	pshell.ar	purge.ar	qmegread.arc
qtip41.ar	r3demo.pak	reboot.pak	recover2.ar	remove.ar	restore.pak

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rewrite.pak	rstdos7.ar	rsdosp.ar	rssave.pak	script1.ar	script2.ar
sd012a.pak	setdkl.ar	setdk2.ar	setjr.ar	shell21.pak	shellpat.pak
sizefix.ar	sortdir.ar	spanner.ar	spint.pak	splitfil.ar	spool.pak
sprint.ar	spunlink.pak	stest.ar	sysparam.ar	transfer.ar	tree.ar
tshedemo.ar	type.ar	uemacs2.pak	ultradir.pak	unfrag.ar	unlzh5.ar
untc.ar	unzip21.arc	unzip3.ar	uptime.ar	utility.ar	utils.ar
vdg.pak	virus.pak	watch.ar	wheres.pak	width.pak	winfo.ar
wrap.ar	wtype.ar	xtractor.ar	yaz.ar	stream.ar	clyde_2.ar
unlzh_7.ar	Cronc.ar	wmode.ar	mkdir.ar	filter.bin	lzh10.ar
ls.ar	checkvfe.ar	un.ar	lha2llb.lzh		

### MULTIPLE SCREENS ON OSK MACHINES

Here's great news for those of us, not many I know, who use OS-9/68000 on a computer which does not have a windowing environment. I recently downloaded from the 'chestnut.cs.wisc.edu' FTP site, a programme called 'screen'. It appears to be a re-compile of the UNIX screen programme, and allows users to access multiple screens with a shell running in each.

Although the programme appears to support up to 32 such screens (memory permitting of course), I have not yet been able to use it above three screens, without a lock-up. However, for most of us, faced with a single screen, this is very welcome. I intend to communicate with the author, to see if it can be fixed to work correctly.

I have only tested the programme on my SECAD, so I can't say whether it will work on any other OSK machine.

The programme was supplied as binary only, which was a merge of screen, pty (the device driver), and 64 device descriptors TTYXX and PTYXX. As well, a file called screen.hlp, about one screen-full, contained the control keys to operate the screen programme.

If anyone wants to try this out on any other OSK machine, the file will become available from the PD library, as usual. Ask for screen.lzh.

regards, Bob Devries.

### Fonts for OS9 Level II on the Colour Computer

I found an archive of fonts which can be used on graphics screens on a colour computer. They are in an archive called 'fonts.ar' in the OS9\_GRA directory in the PD library.

Fonts - Following are the group and buffer numbers needed to call up these fonts for display:

ASCII	- Gp C8, Buffer 04
Bayteeth	- Gp C8, Buffer 05
Blippo	- Gp C8, Buffer 06
Broadeng	- Gp C8, Buffer 07
Broadway	- Gp C8, Buffer 08
Byte	- Gp C8, Buffer 09
Cast	- Gp C8, Buffer 0A
Colossal	- Gp C8, Buffer 0B
Countdown	- Gp C8, Buffer 0C
Cyrillic	- Gp C8, Buffer 0D (Russian fonts)
Data70	- Gp C8, Buffer 0E

Future	- Gp C8, Buffer 0F
Gothic	- Gp C8, Buffer 10 (Caps in Gothic)
Graphic	- Gp C8, Buffer 11 (NO Text characters -- all graphics)
Greek	- Gp C8, Buffer 12
Home	- Gp C8, Buffer 13
Honda	- Gp C8, Buffer 15 (Same as PUDGY font)
IBM	- Gp C8, Buffer 15 (Same as ROMAN font)
Katakana	- Gp C8, Buffer 16
Mirror	- Gp C8, Buffer 17 (All letters in reverse!!)
Outline	- Gp C8, Buffer 18 (Caps outlined)
Overhead	- Gp C8, Buffer 19
Pinocchi	- Gp C8, Buffer 1A
Pudgy	- Gp C8, Buffer 1B (Same as HONDA font)
Relief	- Gp C8, Buffer 1C (Caps letters in relief)
Roco	- Gp C8, Buffer 1D
Roman	- Gp C8, Buffer 1E (Same as IBM font)

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Russbold	- Gp C8, Buffer 1F
Russout	- Gp C8, Buffer 20 (Same as above but some are outlined)
Slant	- Gp C8, Buffer 21 (Italics)
Small	- Gp C8, Buffer 22 (Half size font - no

	diff btw upper/lower)
Start	- Gp C8, Buffer 23
Stop	- Gp C8, Buffer 24
Traffic	- Gp C8, Buffer 25

### **FOR SALE**

For Sale : SCUSI 40meg hard drive with power supply and case. Complete with Disto Super II controller and controller suitable for CoCo3. Original software, RGB DOS and manual, OS-9 Level II disks and manual.

Price A\$650.00 the lot of A\$400.00 for hard dive system only.

Please contact:

RON LIDGARD  
P.O. BOX 237  
CLEVELAND QLD 4164

For Sale : CoCo3 512k with disk controller, 2 off 3.5" Drives, power supply and case, in-built RS232 Pak, Commodore 1084 colour monitor, RGB cable.

Price: \$350.00

GORDON BENTZEN  
Phone 344 3881

### **U.S. OS-9 USERS GROUP**

Just for those OS-9 users who want to keep up to date, why not join the U.S. OS-9 group and receive their MOTD (Message Of The Day) newsletter.

Dues for twelve months (Jan - Dec) are US\$30.00 for members outside US or Canada) write:

THE OS-9 USERS GROUP INC.  
6158 W. 63rd Street  
Suit 109  
CHICAGO, ILL 60638  
USA

### **Chicago CoCoFest!**

The third Annual "Last" CoCoFest will be held May 21st & 22nd 1994

WHERE: The Holiday Inn Elgin  
345 W. River Rd. .  
Elgin, IL

For more details, contact:

The Glenside Color Computer Club,  
RR#2 Box67,  
Forrest, IL 61741-9629

### **CoCo3 HARD DRIVES**

By JW Cross

This article is reprinted with permission of the Glenside Color Computer Club, Chicago USA, from their newsletter "CoCo - 123", April issue. Ed.

**How Large???** How large a hard disk drive can a CoCo3 handle under OS9? To determine the answer, I dug into the OS9 Technical Reference to find the limitations. The folowing limits were found under the Random File Manager (RBFMan) section due to size allocations for specific variable names:

Note: All references to OS9 herein refer to OS9 Level II for the CoCo3.

Path Descriptor variables and size allocations.

1. PD.SID One byte for the number of sides (surfaces) - 256 max.
2. PD.CYL Two bytes for the number of cylinders - 65536 max.

Multiplying 65536 cylinders times 256 surfaces, allows a total of 16,777,216 tracks, but there are further restrictions. Device Description variables (LSNO & Drive Table) and size allocations.

3. DD.TOT Three bytes for the TOTAL number of sectors - 16,777,216 max.
4. DD.TKS One byte for the number of sectors/tracks - 256 max.
5. DD.MAP Two bytes for the allocation bit map size (bytes) - 65536 max.

Multiplying 65536 map\_bytes times 8 bits/byte allows 524,288 TOTAL clusters. Tandy/Microware configured OS9 LII for 1 sector/cluster in several places. Multiplying 256 bytes/sector times 524,288 sectors allows ONLY 134 Megabytes, but fortunately there is a provision for multiple sectors/cluster below.

**Definition:** A cluster is the smallest amount of disk space that OS9 can allocate to a file or directory. That is because each bit in the allocation map represents one cluster.

Each RBF\_type device contains a DD.BIT value in its Identification Sector (LSNO) that tells OS9 how many sectors to include in a cluster for that media

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(disk). As stated above, TANDY set the value equal to 1 which is fine for drives with a capacity of <=134MB.

6. DD.BIT Two bytes - 65536 max - for number of sectors/cluster. See further restrictions below.

RBF Read & Write Command System Calls.

7. Regs B & X Three bytes - 16,777,216 max - for Logical Sector Numbers.

Multiplying 256 bytes/sector times 16,777,216 LSN's allows 4.295 Gigabytes.

Conclusion: Unmodified OS9 Level II is limited to a maximum of 134 Megabytes/Drive, but by changing DD.BIT's value, that limit can be raised to a maximum of 4.295 Gigabytes/Drive.

The DD.... parameters mentioned are stored in Logical Sector Number 0(LSNO) of every disk by the FORMAT utility program which gets them from the Path Descriptor PD.... which gets them from the specified Drive Descriptor IT.... (Initialization Table). Exception: DD.BIT is set to a literal 1 by FORMAT.

I reiterate: as purchased, OS9 level II can handle drives up to 134 MBytes. By making the following small changes, one can raise the limit to 4.295 Gigabytes:

1. DD.BIT must be increased for hard drives larger than 134 Megabytes.

To avoid excess allocated but unused space, keep the value of DD.BIT as small as possible. Increase DD.BIT only for drives larger than 134 MBytes.

The OS9 Tech Manual states on Pg. 5-3 that DD.BIT must be an integral power of 2 (ie 1,2,4,8,16 etc.). Believe it unless you wish to rewrite RBF!

To determine what value to use for DD.BIT, divide the TOTAL number of sectors on the disk by 524,288 (the MAXIMUM number of clusters possible under OS9). If the answer is not an integral power of 2, use the

next higher number that is. Example: Brand X310 MB hard drive has 1,209,868 TOTAL sectors.  $1,209,868/524,288 = 2.3$ . Since 2.3 is not an integral power of 2, the next higher power of 2 is 4, therefore DD.BIT = 4 (sectors/cluster) for this device.

2. The FORMAT utility needs to be changed to compute DD.BIT as described above. I wrote the required patch; it's available free to anyone interested.

\*\*\* CAUTION \*\*\* SCSI drives use only the LOGICAL format feature (L option) of the FORMAT utility, DO NOT attempt to perform a HARD or low level format of a SCSI DRIVE with it.

3. If DD.BIT is made greater than 8, then IT.SAS must also be changed, since it needs to be an integral multiple of DD.BIT's value.

IT.SAS is in the drive's Device Descriptor module and is used to temporarily reserve contiguous disk space when creating a file or directory or expanding a file. The value of IT.SAS is 8 for floppies, and usually 16, 32 or 64 for larger hard drives. I set it to 16 for my hard drive.

Note: There is one GOTCHA to making DD.BIT>1. RBF needs a patch to correctly apply IT.SAS when DD.BIT is >1, otherwise directories are allocated a length of DD.BIT - 1 sectors and Peter Lyall's MKDIR will not work properly on that device. I wrote the required patch; it's also available free to anyone interested.

The results of this study convinced me OS9 could indeed handle large capacity hard drives. I installed a 5 1/4" half height Micropolis 1684-7 380 Megabyte (unformatted) SCSI hard drive onto my CoCo III using a DISTO SC2 with a 4IN1 board, but that is the subject of my next article.

The large fast hard drive really made my CoCo 3 come alive. I much prefer using my CoCo to using the '486DX PC that sits on my desk at work. For one thing, my CoCo has more storage!

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**Home Librarian**  
Written by Robert Heller

Comment by : Bob Devries

I picked up a new programme from the Chestnut FTP site recently. It is a complete home librarian card

database programme that can be used for any collection that can be catalogued by the Dewey-decimal system, e.g. books, tapes (both video and

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audio), CD discs, and records, to name a few. The programme comes as three archives, **h10obin.lzh**, which contains the OS9 binaries, **h10odoc.lzh**, which contains the instruction manual, and **h10osrc.lzh**, which contains the source code (unfortunately in C++).

Here is an excerpt from the user manual: Bob.

The Home Librarian system maintains a database of "cards", which describe books, magazines, video and audio tapes, CDs, record albums, laser disks, and other simular items. The data is indexed by a unique ID for each "card", a title index, an author index, and a subject index. Each card contains fields for a title, an author, a publisher, a year, a volume number, a description, and an item type. The Home Librarian package has six programs: EditLibr for editing card catalog files, Librarian for searching card catalog files, PrintCards for make card catalog cards, PrintLabels for printing item labels, Libr2Ascii for dumping a card catalog file to a plain ASCII text format, and Ascii2Libr for building a card catalog file from an ASCII text file (as generated by Ascii2Libr).

I had two main goals in mind when I set out to write the Home Librarian package. First I wanted to learn C++ by writing some "real" programs, not just the exercises in the book, and secondly, I wanted to write a package to help me deal with my growing library of science fiction books, video tapes, and audio cassettes, which I estimate at about 1,000 items. The first goal has pretty much been reached, in that I believe I have a good working feel for C++. My second goal is still in progress . I also wanted to experiment with writing a shareware package, to see if it is a viable source of income and not too much hassle, that is, to see if the cost/benifit tradeoff is reasonable.

Table 1.1: Indices in a "Card Catalog Data Base".

Name	Description
id	This index is by a unique identifier. Each card has its own unique identifier.
title	This index is the title cross-reference.
author	This index is the author cross-reference.
subject	This index is a subject index.

If you have any comments about this package, please let me know. My electronic mail addresses are listed on the back side of the title page. My postal address is listed in Appendix D. I would be very interested in any comments users of the Home Librarian package might have.

Introduction.

### 1.1 Basic Terminology

The Home Librarian package works over files that are "Card Catalog Data Bases" which contain a number of "cards".

#### 1.1.1 What is a Card Catalog Data Base?

A Card Catalog Data Base file contains a collection of "cards" that describe items in your library, such as books, magizines, records, and tapes. These cards are indexed with four indices as shown in Table 1.1. Each index uses 35 character strings as keys. The keys are always compared in a case-insensitive fashion. That is, "The Door Into Summer" is the same as "THE DOOR INTO SUMMER". Internally, the keys are converted to all uppercase letters. The id index indexes to the card records directly. The other three indices index to lists of ids, and thus index to the cards indirectly, as shown in Figure 1.1.

#### 1.1.2 What is a "card"?

A card has a number of fields as shown in Table 1.2. The id field could be an ISBN number, a LC call number, a Dewey-decimal call number, or any other unique identification code. The type field must be one of the types listed in Table 1.3. The author and title fields are used for the author and title cross-references.

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Figure 1.1: Structure of a "Card Catalog Data Base".

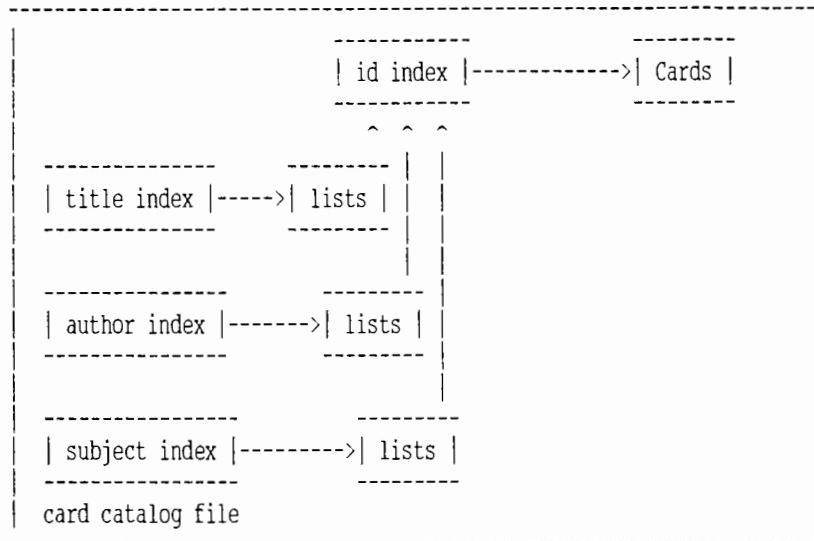


Table 1.2: Fields in a "card".

Name	Description
id	A unique identifier.
type	The type of item the card describes.
author	For the author (or artist).
title	For the title.
publisher	For the name of the publisher.
city	For the city where the item was published.
description	For a long description.
volume	For the volume number.
year	For the year published.

Table 1.3: Allowed types for a "card".

Name	Description
Book	For books.
Magazine	For magazines and periodicals.
CD	For compact disks.
AudioCassette	For audio cassettes.
Album	For record albums.
LaserDisk	For laser (video) disks.
VHSVideo	For VHS format video tape recordings.
BetaVideo	For Beta format video tape recordings.
EightMM	For 8mm video tape recordings.
EightTrack	For 8-track audio recordings.
DAT	For 4mm digital audio tapes.
Other	For anything else.